

Physics 25 Practice Midterm - 50 minutes

2 Pages - turn over!!

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Tuesday, May 2

Write your answers in a blue book. Calculators and one page of notes allowed. No textbooks allowed. Please make your work neat, clear, and easy to follow. It is hard to grade sloppy work accurately. Generally, make a clear diagram, and label quantities. Make it clear what you think is known, and what is unknown and to be solved for. Except for extremely simple problems, derive symbolic answers, and then plug in numbers (if necessary) after a symbolic answer is available. **Put a box around your final answer... otherwise we may be confused about which answer you really mean, and you could lose credit.**

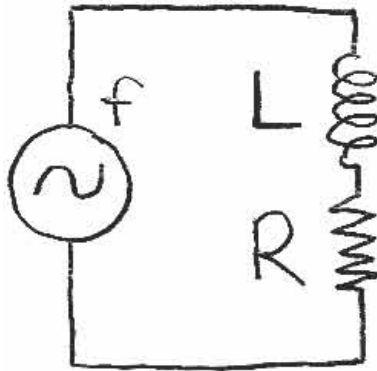


Figure 1: For use in Problem 1.

1. An alternating power supply with peak voltage $V_0 = 10\text{ V}$ and frequency $f = 10\text{ KHz}$ is connected across a circuit as shown in Fig. 1. The inductor has inductance $L = [3/(2\pi)] \times 10^{-4}\text{ H}$, and the resistor has resistance $R = 4\ \Omega$.
 - (a) Find the magnitude of the impedance of the circuit at the frequency of the power supply.
 - (b) Find the phase of the impedance of the circuit at the frequency of the power supply.
2. A capacitor is made from two electrodes that are circular, with radius $b = 2\text{ cm}$, that are placed on a common axis separated by a distance $d = 0.05\text{ cm}$. The charge on the capacitor is $Q(t) = Q_0 \cos \omega t$, where $Q_0 = 100\text{ esu}$ and $\omega = 3 \times 10^8\text{ Hz}$. Find the magnetic field inside the capacitor, at a point halfway between the plates and at a distance $r = 1\text{ cm}$ from the axis, as a function of time, both symbolically and numerically.

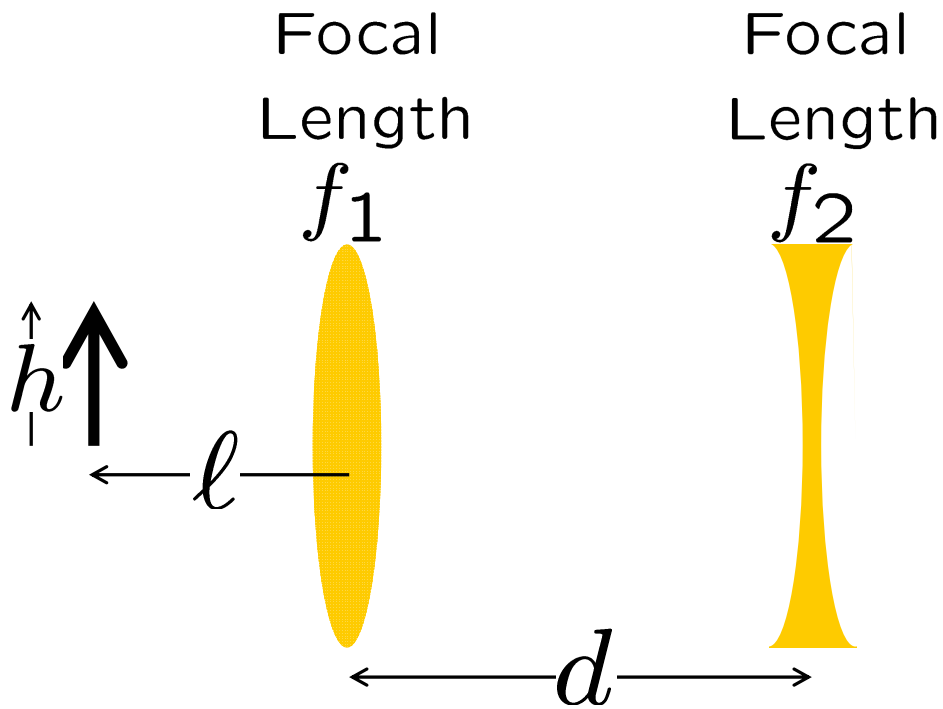


Figure 2: For use in Problem 3.

3. Two lenses are laid out as shown in Fig. 2. An arrow is at a displaced $\ell = -15$ cm from the first lens, and it is $h = 1$ cm tall. The first lens has a focal length of $f_1 = 10$ cm, the second a focal length of $f_2 = -10$ cm, and they are separated by a distance $d = 25$ cm.
 - (a) What is the displacement ℓ'' from the second lens of the image formed by the combination?
 - (b) What is the magnification of the system?
 4. A soap film with $n = 1.4$ is surrounded by air, where light from a helium-neon laser with vacuum wavelength $\lambda_0 = 630$ nm is incident on the film, with angle from the vertical of $\theta = 0^\circ$. The thickness of the film starts at $t = 0$ and is then increased until the first maximum in the reflected intensity is reached. How thick is the film?
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